DOCUMENT RESUME

ED 394 496 IR 017 796

AUTHOR Cole, Beth Rosenstein
TITLE Characterizing On-line Communication: A First Step.
PUB DATE 12 Apr 96
NOTE 32p.; Paper presented at the Annual Meeting of the American Educational Research Association (New York, NY, April 8-12, 1996).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Collegiality; *Communication Research; *Computer Mediated Communication; Educational Benefits; *Electronic Mail; Elementary Secondary Education; Mathematics Instruction; *Mathematics Teachers; National Programs; Teaching Methods
IDENTIFIERS *Listservs; Public Broadcasting Service

ABSTRACT

In response to a call for new content and instructional techniques in the teaching of mathematics, the Public Broadcasting Service (PBS) has launched an organization called MATHLINE, whose first project involved facilitating electronic communication among mathematics teachers nationwide. This document describes a study which examined the members' reasons for joining such a group (MATHLINE in particular), the types of communication fostered, and the perceived benefits of involvement. Messages were downloaded and sorted into statements, questions, and replies. Statements were further scrutinized for elements of fact, opinion, and parable. Questions were subdivided into the pragmatic and the programmatic. Results indicated that replies, whether answers or supporting evidence or yet more questions, were the most frequent kind of teacher-to-teacher online communication. It is hoped that analysis of these messages might be carried further into research on the roles played by different members of an online learning community and the communication patterns between them. Many sample messages are included verbatim. (Contains 13 references.) (BEW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED 394 496

Characterizing On-line Communication: A first step

Beth Rosenstein Cole
University of Wisconsin -- Madison
1025 West Johnson St. Room 575
Madison, WI 53719

email: BethCole@macc.wisc.edu

Presented at the
American Educational Research Association
Annual Meeting
New York, NY, April 12, 1996

I would like to thank Dr. Margaret J. Wilsman and Dr. Mary Harley Kruter of MATHLINE for allowing me the access to make this paper possible. I would also like to thank Dr. Margaret R. Meyer for introducing me to MATHLINE and for her advice during the writing process. In addition, I am grateful to the members of the Spring 1995 Interactive Media and Computers in the Curriculum course under the direction of Dr. Michael Streibel for helping me form many of my ideas.

IR017796

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Beth R. Cole
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

Setting

Mathematics education in the United States is currently undergoing dramatic changes based on new theories of how students learn. In 1989 The National Council of Teachers of Mathematics (NCTM) published a volume called *Curriculum and Evaluation Standards for School Mathematics*. This followed numerous calls for the improvement of mathematics education in the schools of this country and presented an image of what a reformed mathematics curriculum and classroom would look like based on the idea that students learn by constructing their own knowledge.

The *Standards* called for new content in mathematics classrooms. Areas of mathematics once only taught to the intellectually elite, were recommended for all students. Mathematical topics such as algebra, geometry, probability, and statistics, once considered accessible only to high school students, were recommended for middle school and even elementary school students. New curricular materials are being developed to address these changes in content and are beginning to be used in schools.

In addition to changing content, another important component of the reform movement is to change classroom teaching. In 1991, the NCTM published a second volume as a follow-up to the *Curriculum and Evaluation Standards*. This volume, titled *Professional Standards for the Teaching of Mathematics,* directly addressed the changes necessary in the teaching profession in order to make the current reform effort successful.

The current vision requires teachers to teach new content and to teach in new ways. The effort is to change the tradition of lecture and drill in mathematics class. The *Standards* documents discuss active, even noisy, classrooms in which students are active participants in their learning. Mathematics teachers are being asked to learn or relearn new mathematics and teach in radically different ways. The question becomes how best to support teachers as they move toward reformed teaching.

Teaching has traditionally been a profession of isolation (Huberman, 1993). One teacher and many students are together in a closed room. Typically, there are no other adults in the room for the entire year. The teacher's time not spent teaching is often occupied with supervision and administrative tasks. This leaves little time for self reflection and much less for intellectual discussions with peers. There have

been many studies that show an important factor in the success of a reform is a chance for teachers to talk to one another (McLaughlin, 1993). Currently this is not possible for most teachers.

One forum in which teachers can "talk" to each other is through electronic communication. The Public Broadcasting Service (PBS) is one organization facilitating teachers' electronic communication. Their effort, MATHLINE, is an umbrella organization that will offer a variety of on-line services for teachers and students. The first project of MATHLINE is called the Middle School Math Project. Teachers involved in the project are all given electronic accounts accessible through local or toll-free telephone calls. Groups of 25 to 30 teachers are connected to a learning community that is headed by a facilitator. Members of a learning community are located in the same geographical region and are sponsored by a local PBS station.

Each teacher who is a part of MATHLINE receives a set of 25 video tapes and she or he views a particular one at about the same time as the other members of their learning community. After a video is viewed, each teacher is expected to try the lesson presented on the video tape in their classroom. The lessons are created to align with the *Standards* documents in terms of both content and approach. All of the videos for the 1994-95 school year focused on classroom discourse, one of the components of the *Standards* documents. Before, during, and after the teachers try the lessons, they communicate with other participants in their learning community using the MATHLINE network.

In addition to having access to the learning community, teachers have access to a national forum. In this electronic area there are no facilitator or moderators, and messages are open to all MATHLINE participants. While the discussions on the local board usually focus on the content of the video tapes, the national discussions are completely open. Teachers have the opportunity to discuss scheduling, curriculum, assessment, or anything else of interest. The topics on the national board have varied greatly this year.

PBS identifies the following as the advantages for teachers participating in the Middle School Mathematics Project:

> Teachers gain:
> greater experiences with mathematical content and teaching techniques for implementing Standards-based instruction;
> ongoing support from peers;
> expanded awareness of mathematics reform efforts implemented by others;
> contacts with colleagues in other schools and systems;
> professional experience in using distance education and online telecommunications.
> (Public Broadcasting Service, 1995)

Last year, I had the opportunity to participate in the national forum of MATHLINE as a guest. Similar to other guests, I was not given access to any of the learning community communication. While I chose not to post any messages on the national forum, I read parts of the conversations that took place. Over the past four years I have worked as a member of a curriculum development team. We are developing a mathematics curriculum for grades five through eight and are funded by the National Science Foundation. The curriculum, called *Mathematics in Context*, (National Center for Research in Mathematical Sciences Education & Freudenthal Institute, in press) attempts to be true to the vision presented in the *Standards* documents. I worked closely with teachers through the pilot and field test stages of the project, and served as the site liaison to two very different school districts attempting to implement the curriculum. Through these experiences, I have learned first hand about the difficulty of trying to change teaching practices and implement new content simultaneously. This has made me think seriously about investigating the possibilities of using an electronic medium as a means of support for teachers in the process of implementing a reformed curriculum.

I am interested in studying a group of teachers who are members of an on-line community. I want to examine three interrelated components of participation: a) members' reasons for joining the group, b) the communication that takes place, and c) the members' perceptions of the benefits of involvement. Once I have gathered information on these three components I would like to determine if there are any connections among them. I think information of this kind would be useful to those developing further electronic forums for teacher communication, and may help to

inform professional development in general. In thinking about this study, I was overwhelmed by the second component. It was clear to me that I wanted to do more than just report the number of messages sent and read. I wanted to be able to describe both the content and the character of the messages and conversations.

In a preliminary review of the literature, I was surprised to find that there was very little characterization of teacher-to-teacher communication on-line. Much of the literature I located did use excerpts from messages, but did not make generalizations about the character or content of messages (for example DiMauro and Jacobs, 1995; Jacobs and DiMauro, 1995; Weir, 1992). I was able to locate some work describing on-line communication. For instance, Paget, Ishihara, and Roberts (1995) describe some of the characteristics they observed in messages that were part of conversations between teachers on the NGS KidsNetwork. They identified statements made by teachers that seemed to encourage conversation. Gal and DiMauro (1994) identify three modes of network communication: informative, responsive, and reflective. Each mode, they conclude, leads to messages that differ with respect to content, intent, and length of message. In addition, West and her colleagues (1989) in their work on the Science Teacher's Network identified four overlapping characteristics of messages: specificity of topic, social engagement, formal vs. informal style, and expression of personal opinion or affect. While the dimensions identified by both Gal and DiMauro (1994) and West et al. (1989) seem useful, neither developed the kind of detailed characterization for which I was looking.

I determined that a more detailed framework to characterize the individual messages in teacher to teacher electronic communication would be useful. To that end, the rest of this paper describes my framework and the process used to develop it. By using a relatively small data set I hoped to lay a groundwork for a framework without becoming buried in data. I think that the proposed framework will be useful as I explore the larger proposed project.

Process

I chose messages from the national MATHLINE bulletin board as the data for this project. The general nature of the bulletin board was described above. In order to narrow the focus I selected only messages with the word "algebra" in the title and a few other messages that were referred to by messages selected with the above criteria. This selection was somewhat arbitrary. There were 90 messages between January 1, 1995, and April 1, 1995, fitting this category, which seemed to be a reasonable amount of data from which to work. Since algebra is a very emotional topic for many teachers I predicted that these would provide a variety of message types.

To begin looking at the data, I downloaded it from the network and saved each message separately. A message is a single component on the forum. Each message is written by a single person and then posted to the group. Because I needed some way to refer to the pieces of data, the individual messages, I numbered them. After numerous readings of the whole set, I began to think about ways to describe my observations. I realized that the messages seemed to fall into a number of different types, so I classified each message according to initial categories, which I continued to refine.

Once I had the general categories, I began to break the categories into different types within the each category. I then identified characteristics of each type and chose exemplars from the data. My goal was to describe the different kinds of messages that teachers used on the national forum in as much detail as possible. My hope is that this framework will be useful for looking at other groups of messages as well. What follows is the framework I developed from this small data set

Framework

Right away it was clear that messages were used for different purposes. Some people were seeking particular information, while others were looking for more general information or feedback. Some people were providing information and other people were stating opinions or suggesting ideas.

I identified three general categories to begin to classify the messages. The three categories are *statements*, *questions*, and *replies*. Once I identified these categories, I reread each message and placed it into one of the categories. This proved to be difficult because some messages appeared to fit into more than one category. I decided that any message that could be identified with, or tied to, a previous message should be called a *reply*. A message could be identified with another message if there was a particular recipient listed in the address line or if part of the message referred to another message. It is important to note that some messages with RE in the subject line were not classified as replies because they could not be clearly identified with a previous message other than by the title. With this decision, the reply category became very large, but it was easier to classify the messages consistently. Because of the nature of the messages, I did not have any difficulty distinguishing statements and questions. Any message that asked a direct question was classified as a *question*. Any message that made a statement or told a story without asking a question was classified as a *statement*.

Once each of the messages was placed in a category I carefully examined the messages within a single category to look for similar characteristics among these messages and to determine whether there should be distinctions among different types of messages within the category to form a better characterization. I use the term *category* for the major divisions, *type* for the divisions within a category, and *kind* for the divisions within a type. Figure 1 contains a representation of the structure I settled on. The labels used in Figure 1 will be explained in the following sections.

For describing some of the aspects of the messages, I have found the work of Brown and Duguid useful. In their article, "Borderline Issues: Social and Material Aspects of Design," (1994) they discuss a number of ideas that are useful in the discussion of the messages. They discuss context in terms of center, periphery, and border. The idea of a center is that which is central to the context in question. At various points in my discussion I will point out the center of a message as a way to distinguish one type from another.

The periphery encompasses all related aspects not in the center. Features in the periphery

are useful in the context but are not central to it. However, the distinction between the center and periphery are not always clear. Brown and Duguid write "aspects of an artifact regarded as part of the canonical center from one standpoint may be regarded as quite peripheral from another." (p. 7) The components of the periphery are individual. Different people may see the same object or idea as peripheral while others see it as unrelated. In examining on-line communication, the concept of the periphery is interesting when there is a shift from an aspect being in the periphery to being in the center.

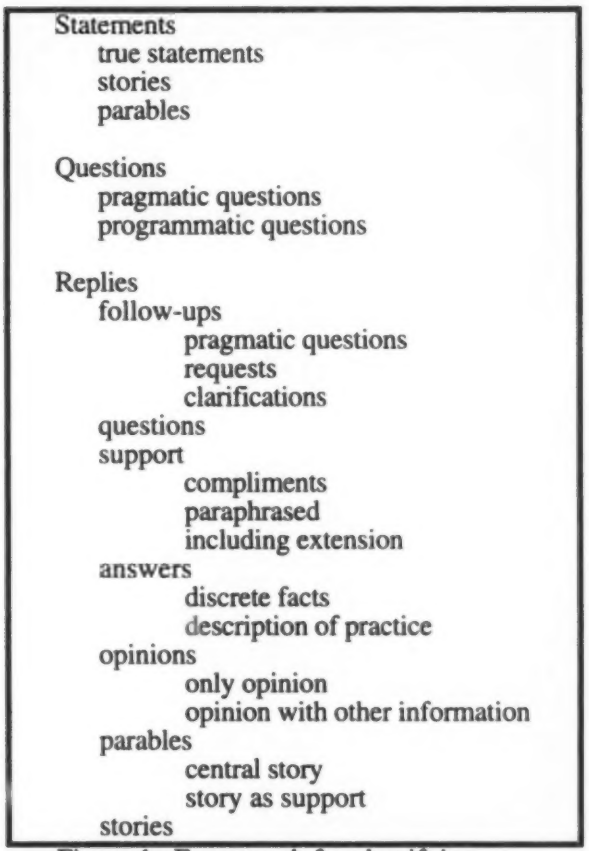

Figure 1. Framework for classifying messages

The center and the periphery meet at what Brown and Duguid call the border. They point out that "in practice, the border may be inseparable from both the center and the periphery of an artifact, but analytically it stands distinct from each." (p. 8) An aspect on the boarder, like one on

the periphery, does not play a central role in the context. However, aspects of the border are not in the periphery because they "play a socially recognized role." (p. 8) The distinction is that the border resources are socially shared. "The border comprises those aspects of the artifact and its periphery that are available to each person involved in a particular interaction with that artifact." (p. 8) How the border resources are indicated and used is included in the discussion of the messages.

I have applied the concepts of center, periphery, and border to the algebra messages in the following way. The center is the subject of the message. The periphery is the participant's experiences relating to the center or subject. The border is the conventions of schooling relating to the subject. My notion of the border came about when it became clear from the messages that the teachers did not feel a need to explain certain ideas. For example, some messages used the term "math 8" with no indication of what this was. Because the readers shared the border resources of math teachers, they were clear that "math 8" means a general math class for eighth grade students and does not include aspects of algebra. Because of these border resources, the messages could become more concise than would have otherwise been possible. These ideas of center, border, and periphery are used in the discussion that follows to help characterize the messages.

The center of a message is the goal of the message. As an example, If I were writing a message explaining that the sky is falling, that would be my center even if I did not state it directly. In this message, my periphery would be whatever caused me to believe that the sky was falling, perhaps a stone hitting my head. The border resources would be what the readers know about the situation, perhaps the knowledge that the sky has not yet fallen. The reader uses border resources to interpret my message, and perhaps to question me about the validity.

In the following discussion of the types and characteristics of messages, I have used messages from the MATHLINE national forum. Each of the messages has been reproduced in its entirety without any attempt to correct spelling, grammar, or other errors. I have changed only the names and other identifying features, but have been consistent in doing so. While it would be possible to describe my framework without reproducing the messages, I feel that the inclusion of

actual messages is necessary to provide exemplars of the classifications.

Statements

The first category of messages I looked at closely were those I classified as *statements*. Statements are easy to distinguish from questions. They do not ask a question. I did, however, have difficulty distinguishing statements from replies. To make this distinction, I made the following decision. *Statements* are messages with no particular reference to a previous message. This does not mean that the subject line of the message was different from others, but simply that the message was not addressed to another individual nor did it quote from or directly refer to another message. There were a few messages for which I had to bend this rule slightly. A few messages appeared to refer to a previous message that I was unable to locate. I classified these as statements.

Thirteen of the 90 messages were statements. The statements varied in length from two lines to a full page. All had clear centers, although not always directly stated.

When reading the statements, it became clear that there were three different types of statements. The first type is *true statements* which are simple statements, usually projected as an opinion. The second type is *stories*, which are about a particular incident that happened to the writer. The third type are *parables*. These are stories presented to advance a particular opinion. In parables, the story is offered as evidence for the opinion.

True statements.

Four messages were true statements. They were all brief. One of the messages was on the line between a statement and a question.

Thursday, 24 November 1994 5:26:56pm
MathLine Bulletin Board Item
From: Jennifer
Subject: Re(2): 8 TH GRADE MATH TEACHER
To: MathLine Bulletin Board

Hi Dennis,

I am an eighth grade teacher of Pre-Algebra and Algebra. I would like to share ideas with you. I teach at the Thomas Michaels Middle School in city, state, zip. I try to attend any conferences that are pertinent to my field.

Hope to hear from you.

Jennifer

The message conveys information about the author but the center is a request for contact. The other messages were more similar to one another.

The other true statements presented an opinion, apparently to open discussion. The directness of the presentation varied, however, as the following two messages demonstrate.

Tuesday, 31 January 1995 9:10:59pm
MathLine Bulletin Board Item
From: Harriet
Subject: Re(2): Fwd: Re(2): Hello--is anyone out there?
To: MathLine Bulletin Board
I too am amazed at all 8th graders taking algebra. As of this year NONE of our 8th graders take algebra. All take pre-algebra-pre-gemotry.

Friday, 10 February 1995 10:45:29pm
MathLine Bulletin Board Item
From: Elizabeth
Subject: Wouldn't it be wonderful if....
To: MathLine Bulletin Board

Okay all you dreamers... Here's a new thread to start on the bulletin board

Wouldn't it be wonderful if

Middle School Mathematics was so exciting to students (and parents) that no one wanted to take algebra in the eighth grade????

Add your ideas!

The center of true statements is an opinion or idea. However, there is also an expectation of discourse. The teachers seemed to post true statements in order to get replies. In this way, true statements are similar to questions.

Stories.

The second type of statements are stories that are shared without an attached opinion. In these messages, the actual events form the center. There was only one of these in my data set.

> Sunday, 19 March 1995 11:33:04pm
> MathLine Bulletin Board Item
> From: Jane
> Subject: Re(3): Why algebra
> To: MathLine Bulletin Board
>
> I have just finished using a part of a Creative Publications binder called ??? (something like First Algebra Lab). It has a section on Science Collections where students work with clues such as:
>
> > John collected 14 insects in all.
> > He collected the same number of grasshoppers as crickets.
> > He collected 1 fewer ladybug than crickets.
>
> The goal is to have the students solve the problems, and also to learn how to express these clues using variables.
>
> My 7th graders were able to translate the above into:
>
> > $C + G + L = 14$
> > $G = C$
> > $L = C - 1$ (this was the toughest)
>
> Then we switched the problems around. I gave them the abstract clues, and they wrote out the verbal clues and found the solutions.
>
> > $(1/2)(C + G + L) = G$
> > $L = C$
> > $G = 6$
>
> My students have come a long way in the last two weeks, as most of them started out using the L, G and C as labels, rather than as unknown quantities.

I was surprised by the lack of stories. I had expected teachers to share more stories about what they had done and about what their students had done. What I found was that instead of sharing stories, they shared parables.

Parables.

Most of the stories that the teachers shared were told to make a point. I call these parables. The center of the message was an opinion rather than what actually occurred. The context served to frame the opinion inside a "fact," or at least inside an "experience." Border resources come into play in these messages as well. In all of the parables there is a strong underlying assumption about the shared goals of education, as this example demonstrates.

> Saturday, 21 January 1995 12:56:12pm
> MathLine Bulletin Board Item
> From: Homer
> Subject: Re(3): Who should be in Algebra I?
> To: MathLine Bulletin Board
>
> In addition to teaching our advanced 8th graders Course I (In state we don't have Alg I anymore...we have Course I, II, III which integrates all the material from Alg I,II, Geometry & Trig and also includes logic, probability and statisics.).....anyway.....in addition to teaching that class for our 8th graders at Sheehan Middle School and 3 "regular" 8th grade math classes, I also teach a math class at a local state university. I met with my 2nd semester class the other night for the first time and was trying to get a "feel" for their math backgrounds. One girl told me she was in the advanced 8th grade class for Course I and took Course II as a freshman and then did not take another math class in high school.....WOW!! Can you imagine???? What does that say for the selection process at whatever school she came from. Pretty scary!! I think we have to continuously re-evaluate each student who is in that advanced class. If they're struggling.....shouldn't they feel comfortable going to a regular class.....are we putting too much pressure on them to stay in the class....we meaning parents.....peers.....teachers???

When Homer writes "WOW!! Can you imagine????" it is clear that he is both expressing an opinion and relying on the border resources of the group. He is outraged, and counted on the shared knowledge of the group to understand why he is.

The fact that there were more parables than any other type of statement intrigued me. I think that this may be because teachers are uneasy about expressing opinions outright without couching them with some sort of justification. This makes the parable more natural than the true statement. In addition, I think teachers may not see a value in simply sharing stories. They tell stories to make a point, and choose their stories very carefully.

I do not think the types of statements I found were affected by my choice of data. The proportions may be slightly different in other sets of messages, but I hypothesize that the parable will remain the most common type of statement made by groups of teachers discussing any content area. However, this may not be true for non-teacher groups. The border resources of teachers makes the parable particularly effective.

As a whole, there were not very many statements. I had expected that teachers would have a lot of information to share and would thus make many true statements. One explanation may have been my choice of topic. It may be that there are not many middle school teachers who have statements to make about algebra. This could be investigated by looking at another data set. Another possible explanation is that many of the teachers are not willing to "stick their neck out" to make a statement. They may be more comfortable writing replies. I was not surprised by the frequency of parables and stories. I think that electronic communication and the teaching profession both support their use.

Questions

Of the 90 messages gathered, I categorized only five as questions. This was surprising, since I had expected a majority of the messages to be seeking information. In fact, there were more questions posed then were categorized as questions, as will be discussed in the section replies.

The first noticeable characteristic of the questions was the brevity of the messages. The longest was only six lines. The teachers stated their questions simply and directly. This indicates one of two possibilities. Either they asked very simple questions that required no background, or their shared border resources as a group of teachers was so strong that there was no need for extensive stage setting. I am inclined to believe the second reason. While some of the questions appear simple, it is clear that one would have to be closely involved in education in order to consider what an answer could be.

Pragmatic questions.

The questions they fell into two types: *pragmatic* and *programmatic*. The one message that was pragmatic asked for particular advice.

> Friday, 6 January 1995 2:47:06pm
> MathLine Bulletin Board Item
> From: James
> Subject: Help Me With Algebra
> To: MathLine Bulletin Board
>
> My Algebra students are getting bored. Any suggestions for interesting activities?
> Thank you!
>
> James

This question is very personal in nature, and there is the implication that a quick reply is necessary. While the message is very short it is clear that the author has made assumptions about the experiences of the readers and believes that they are in positions to offer answers.

Programmatic questions.

Messages of the other type, *programmatic*, sought advice on broader issues, particularly curriculum issues.

> Thursday, 9 March 1995 1:40:54pm
> MathLine Bulletin Board Item
> From: Helen
> Subject: Re(3): Grade 8 Algebra
> To: MathLine Bulletin Board
>
> Regarding Algebra- How many of you have Algebra I as a high school graduation requirement? If so, what grade do you start to offer this credit at? What is the success rate?

Again, the message is very direct. Questions of this type appear to be more global than those of the pragmatic type.

When people post questions, they expect answers. I decided to look at the type of information sought to see if that would help in characterizing the questions. The questions seemed to seek three different types of answers: *particular information, personal experiences or opinions*,

or *information on schools*. This message is one seeking particular information.

> Tuesday, 10 January 1995 7:41:05pm
> MathLine Bulletin Board Item
> From: Denise
> Subject: Re: Why algebra
> To: MathLine Bulletin Board
> Ronald
>
> Ronald,
> I talked to you in Salem this fall about not teaching Algebra at our middle school and suspect that you support the idea. Do you know of any research to support the stand? The moans and groans of stressful memories is emotional, but the pushy parents are hard to dissuade from that driveness.
>
> Denise

The other questions were not as clear in the type of reply sought. Two of the questions asked for personal experiences and opinions.One was looking for other teachers to share an experience from their school on a particular topic. The remaining message, the one from James above, appeared to seek both personal experiences and data, in this case in the form of particular activities.

Because of the small number of questions posed, it is not clear that this is an exhaustive discussion of the characteristics. I think that the pragmatic/programmatic distinction is useful when looking at teachers' questions. I also think it is useful to look at the type of information questions seek.

I was very surprised at the small number of pragmatic questions posed. I do not think that this is because teachers do not have pragmatic questions. This raises the question of why they did not ask them on-line. I pose a number of possible answers. As I discussed briefly in the introduction, teaching has been a solitary profession. There has been a tacit assumption that everyone knows what he or she is doing. Because of this there, may be a degree of embarrassment in posing pragmatic questions. Because these teachers had access to another forum, their learning community, it is possible that they posted their pragmatic questions there, where they were likely more comfortable with others participants who read the questions. This could be investigated by looking at the messages in one or more of the learning communities.

(Note: I did not have access to messages in the learning communities at the time of this work, but hope to in future work.)

Another possible explanation for the lack of pragmatic questions may depend on the topic. In general, few middle school teachers teach algebra. Thus, few of the participants were in a position in which they encounter pragmatic difficulty with algebra. Another topic could be examined to determine if more pragmatic questions are posed.

While there were not many questions posed, the ones posed were clear in their expectations. A reader would be able to understand what was being sought and would be able to determine easily if he or she would be able to answer. It is clear that teachers respect one another's opinions and are interested in what goes on outside their classrooms.

Replies

By far, there were more replies than any other category of message. There were 72 messages, 80%, categorized as replies. A message qualified as a *reply* if it was clear that the message was prompted by another message. This means that each reply was addressed to another teacher or referred to another message. As with the other categories, I found that there were different types of replies. I identified seven different types. Some reply types are closely related to types of statements or questions. Others reply types are found only in replies. Most of the types were still too general, so many are further divided into *kinds*.

Follow-ups.

The easiest type of reply to describe is the follow-*up*. These messages are always questions. There are three different kinds of follow-ups: *pragmatic questions*, *requests*, and *clarifications*. Most of these messages were short, with gathering information as the center. An important border resource, however, was the previous message or messages that prompted it.

Pragmatic question follow-ups were very similar to the pragmatic questions that were not replies. The messages ask questions ask how to do something. The following is one of the

pragmatic questions posed as a follow-up reply.

> Thursday, 19 January 1995 9:27:35pm
> MathLine Bulletin Board Item
> From: Vida
> Subject: Re(2): Help Me With Algebra
> To: Shannon
> Cc: James
> MathLine Bulletin Board
>
> Shannon,
> I became involved in Mathcounts last year, and I have learned so much from the problems. I wanted to try the activities you mentioned, but I planned on using my 8th grade honors class as guinea pigs. Do you think 9th graders who are taking Pre-algebra this year (they are very week in math) could be successful with these activities? I would like to find something stimulating but not too challenging for this group.
> Vida

The difference between pragmatic questions posed as follow-ups and those posed as questions was the position of the messages within a conversation.

The second kind of follow-ups is *requests* for particular information. In these, the center was clearly the collection of information. However, different from the pragmatic questions, the information sought was not practice oriented. There were five follow-up requests. Three of these were requests for materials mentioned in other messages. The other two were slightly more general but were still primarily requests for information.

> Saturday, 25 February 1995 9:19:26pm
> MathLine Bulletin Board Item
> From: Doris
> Subject: Re(4): Help Me With Algebra
> To: Edward
> Cc: MathLine Bulletin Board
>
> Hi Edward. Please advise about Davis Algebra information and Saxon if you have it. My math coordinator is looking to obtain more info about both of these publishers. Thanks. Doris

The requests were very short and pointed. They could each be answered with a single piece of information.

The third type of follow-up is *clarifications*. These were questions that were posed to help

the author understand a previous message. There were four clarifications in the data I examined. The clarifications ranged from very direct and easily answerable with a fact, to others that were more detailed and difficult to answer.

> Wednesday, 1 February 1995 4:53:01pm
> MathLine Bulletin Board Item
> From: April
> Subject: Re: algebra for all eighth graders
> To: MathLine Bulletin Board
>
> Gladys,
> Are your kids tracked?

> Tuesday, 17 January 1995 7:26:02pm
> MathLine Bulletin Board Item
> From: Joseph
> Subject: Re(3): Why algebra?
> To: MathLine Bulletin Board
>
> I'm not at all sure that the data Ronald reported can be used to support or argue against having algebra available for 8th graders.
>
> Here are some questions that I have: What was the nature of this exam? What measure was used to rank the states? Exactly which students participated in the exams? How did the kids taking algebra fare in each state? Is dead last bad? Is placing first good?

Each of the clarifications asked a question that was directly related to a previous message. The center was to obtain information that would help in answering a question posed in the previous message.

Questions.

Reply *questions* depend on a previous message; hence they are replies. But they also advance the conversation, which separate them from a reply follow-up. The center is a new question rather than clarification. There were four reply questions in the data set. The reply questions appear to deepen the conversation or move it to a more philosophical level. They also provide information to frame the question and many begin to suggest answers to the question posed rather than simply posing a new question.

Thursday, 19 January 1995 9:32:30pm
MathLine Bulletin Board Item
From: Joseph
Subject: Re(5): Why algebra?
To: MathLine Bulletin Board

I agree that we need to have discourse about mathematics reform. I also feel that there has been a premature rush to push algebra downward into middle school. My main concerns there are: What algebra? and What next?

By that I mean, what is the content and approach to be taken in the algebra and, will the student be expected to continue the study of mathematics throughout high school? In particular, will the student have the opportunity and guidance to complete four more years of high school mathematics? Or is the algebra in high school just a headstart on the minimum graduation requirement?

Now, the reason I got into the discussion at the point I did is that I think we need to be on firm ground as we seek to support one position or another. I am especially sensitive to appropriate uses of test data. For too long we have been using narrow measures of mathematical achievement (translation: computational facility) to measure program success. Since I am not familiar with the tests you cited nor with the standards which were used to decide which groups did better than others, I felt it was important to raise a flag of caution. It may be that the algebra program in DC is doing a great job without having any impact on those test results. It would be a shame to miss a successful program by using inappropriate measures of achievement.

I am also very cautious when reading about measures of large populations which are depicted with a single number (e.g., average score, percent scoring above some norm, etc.). I'd much prefer to see the results depicted as distributions of scores. Then we could get an idea of the full range of achievement and maybe even be able to see where important subgroups of students scored (e.g., the algebra students, girls, minorities, etc.).

As curriculum reform moves us closer to the vision of mathematics education described in the NCTM Standards, assessment will also need to reform. In some cases the assessment reform is pulling curriculum reform in the "right" direction. In other cases it is forming a block which is inhibiting that reform. It's important for all of us to make sure that assessment is measuring what we value and to help identify assessments which are faithful to the content and approach described in the NCTM Standards.

Thanks for keeping the discussion going.

8-)

It is clear from the last line of this message that Joseph is interested in the continuation of the discussion. By posing a reply question he has provided more opportunity for people to get involved.

Support.

Support is the next type of reply. These do not significantly contribute to the discussion taking place. They do, however, acknowledge previous messages. I labeled 13 messages reply *support*. Within this type there were three different kinds of support messages. All of the reply support messages depend on previous messages, but the first kind, *compliments*, only make sense if the previous message is known. These simply compliment the previous author of a post.

> Saturday, 25 March 1995 6:58:26am
> MathLine Bulletin Board Item
> From: April
> Subject: Re(4): Why algebra
> To: MathLine Bulletin Board
>
> WELL PUT, Wendy!
> (:

These messages do not advance the conversation. They do, however, encourage others to share and serve as a way to recognize or credit people who write what are perceived as particularly good messages.

The second type, *paraphrased*, is very similar to support. The only difference is that in paraphrase messages there is some paraphrasing of the message being complimented.

> Tuesday, 14 February 1995 8:33:59pm
> MathLine Bulletin Board Item
> From: Sharon
> Subject: Re(5): Algebra
> To: MathLine Bulletin Board
>
> I'm replying th Doris's story about her student realizing she could do math and actually be pretty good at it. It's a great story, and we need lots more like it. I believe that what we're learning through this communication will help all of us have stories like this to tell. I sure hope so!!

Again, the center is a compliment, but in these messages it is possible to know what is being

complimented without having to trace back through previous messages.

The final group of reply support messages, *including extension*, is an extension of the paraphrased support type. In these messages there is a paraphrasing of or reference to a previous message and a compliment to the previous author, but there is also an extension. The author typically adds his or her own opinion and sometimes some reasoning.

> Wednesday, 25 January 1995 5:55:44pm
> MathLine Bulletin Board Item
> From: Jessie
> Subject: Re(2): Algebra
> To: MathLine Bulletin Board
>
> You said:I'd just prefer to see middle school be a time to foster understanding, problem solving, communication and connections and build a solid base for the rigorous high school mathematics program.
> AMEN!!
> I see a lot of push from parents. We now have 6th graders in pre-algebra so that they can take algebra as 7th graders. Placement in a "higher level" math class is now quite the status symbol.

Different from the other groups of reply support messages, the including extension messages can contribute to the conversation in a substantive way. There is a dual center of a compliment as well as the expression of an opinion.

Answers.

While most of the reply support messages do not advance the conversation, the remaining types of replies do. These are *answers*. These messages contain facts which are in reference to a particular message: either a question, a reply question, or a follow-up. The center is a piece or pieces of factual information. There are two different kinds of answers. The first kind, *discrete facts*, provides the name of a source, some piece of historical information, or some other discrete fact. The other kind, *description of practice*, provides factual information about what the author or the answer actually does.

There were 14 reply answers. Ten of them were discrete facts.

> Friday, 24 February 1995 1:03:32am
> MathLine Bulletin Board Item
> From: Gregg
> Subject: Re(3): Help Me With Algebra
> To: MathLine Bulletin Board
>
> Check our [out] College Prepatory Mathematics from Davis University or Interactive Math Project from Berkeley.
>
> Gregg

Four others were description of practice.

> Wednesday, 18 January 1995 2:08:19am
> MathLine Bulletin Board Item
> From: Shannon
> Subject: Re: Help Me With Algebra
> To: James
> Cc: MathLine Bulletin Board
>
> I have some projects that I have done with my algebra kids this year and in the past. This last week they completed designing a golf course to meet a list of specifications I gave them the sprinkler system for it. They really enjoyed the project. I found this idea in my MATHCOUNTS book. Last year's book had a project in which the kids designed a house, figured out the cost using a few formulas and then the selling price using some other set formulas. Another good project. There is another project in this year's MATHCOUNTS book that involves designing a pop can involving surface area and volume.
>
> Let me know if you are interested in more information or copies of my materials.
>
> I teach 8th grade at Fulton Middle School in city, state. I have four math classes and two reading classes this year.

Answers, as different from the remaining types of replies, are factual. The center is a piece of information, either about what someone does or another type of information. I found that answers were especially likely in response to questions that sought either particular information or facts from other schools.

Opinions.

There is another type of answers that form a different type of reply: *opinions*. Reply opinions answer a query or extend the discussion based on a previous message, but they do so by

providing an opinion. The opinions are often supported by facts but do not use anecdotes because these are considered a separate category.

In the eleven messages that I categorized as opinion replies there were two different kinds. The first were *only opinions*, and stated as such.

> Thursday, 16 March 1995 8:04:10pm
> MathLine Bulletin Board Item
> From: Bernie
> Subject: Re(3): Grade 8 Algebra
> To: MathLine Bulletin Board
>
> Dear Darrin,
> "A universal edict " so that all "curriculms could be paralleled as close as possible throughout the country" is a very scary image to me. What if someone makes a typo in the edict. Seriously, I believe that there is strength in the diversity that you referred to in the opinions expressed.
> Bernie

The second kind, *opinions with other information*, gave an opinion but also provided some other information often some sort of reference either to decisions made by curriculum projects or to research.

> Wednesday, 1 February 1995 1:35:23pm
> MathLine Bulletin Board Item
> From: Shanta
> Subject: Re: Grade 8 Algebra
> To: Darrin
> Cc: MathLine Bulletin Board
>
> I think having all 8th grade kids taking Algebra (if the Algebra is the traditional high school course) is absolutely ridiculous! (You DID ask for our opinions! (:)
>
> Anyhow, based on the readings I've done, the videos I've watched, and the discussions I've had, the traditional Algebra course is a waste of time no matter WHEN it's taught! There are far too many valuable math concepts that can be worked with at the middle school level to better empower our youth for the world in the 21st Century!
>
> Shanta, President
> state Mathematics Council
> and a state Mathline Facilitator

Both kinds of opinions were fairly direct and centered on an opinion which was very clear.

Parables.

There are two remaining types of replies. Both are very similar to the two types of statements discussed previously. These are stories and parables. *Parables*, like the reply opinions just discussed, provide an answer that is an opinion. These are different from opinions because the use the form or a story to convey the opinion. The center is the opinion, but a story is used to reveal the author's peripheral sources. Like the statement parables, parables as replies were popular. There were 14 reply parables.

There were two different kinds of reply parables, *central story* and *story as support*. In *central story*, the story is as central as the opinion. These are longer and more involved stories, but they still have a particular opinion being expressed.

Thursday, 2 February 1995 3:41:27am
MathLine Bulletin Board Item
From: Doris
Subject: Re(4): Algebra
To: Harold
Cc: MathLine Bulletin Board

Hi Harold. I am a second year sixth grade math teacher. My last class often comes up to me and complains about math. So many kids still hate math. The kids coming in were and some continue to be fearful of failing math. Some still dislike it. But one thing I am finding out. Kids don't learn math like we did in years past. Today I gave a math test. I tried to give a lot of practical applications...no rote drill and practice. Situations were created that the kids could relate to...babysitting, earning money, measuring, critiques of math, etc. I tried anything to get the kids to relax and just show me what they could do. One student came up to me and I asked her how she felt. She didn't need to tell me. I saw it in her face. I quickly glanced at her paper and noticed many right answers. I told her I knew she would do just fine. Her eyes fill with tears and she said, "I just don't do good in math". Well, you can guess it... I corrected her paper right then and there. She got a B- and for her that was an A (if you need to put a mark on her performance). I went up to her and touched her shoulder and told her that she is better at math than she thinks. I told her that if she could do the assignment that I gave to her and do as well as she did, I knew she not only knows math, she is good at it. Naturally she began to tear up again, but this time because she is beginning to gain confidence with her abilities. She didn't have to perform 100 questions. She put math into perspective and was able to use it to succeed in like situations. Kids need this. Somehow teaching math has got to be more experiential and tangible. Too many kids have failed with numbers and don't know

how to use them in practical ways. Seventh graders will like math more when they don't have to answer problems...they need to explore math. Doris

Doris's opinion is stated in the last few lines. However, she provides the long and involved story as evidence of the truthfulness of the opinion.

The other kind of reply parable, *story as support*, includes much shorter stories. These are more fact-like but they are distinguished from reply answers because they are clearly anecdotal.

Thursday, 26 January 1995 4:48:48pm
MathLine Bulletin Board Item
From: Jessie
Subject: Re(4): Algebra
To: MathLine Bulletin Board

I see many grade 7 students enjoying math. A number of former students return to say that 7th grade math was fun and 8th grade math is boring. I think it depends on how it was presented. Right now my regular (as opposed to pre-algebra) classes have decided that multiplying and dividing fractions is great fun!! They think reciprocals are neat and today some students told me that math is the only class no one ever falls asleep in---

These are still parables, but the opinion is the only center; the story simply provides a backdrop.

Stories.

The final type of reply is *stories*. They are tied to a previous message but do not provide an answer. Rather they move an aspect of one person's periphery into the border. These stories become part of the social knowledge when they are shared. The center is the story itself. There were three reply stories in the data. This is one of them

Wednesday, 11 January 1995 6:47:01am
MathLine Bulletin Board Item
From: Eileen
Subject: Re: Why algebra
To: MathLine Bulletin Board
Ronald

Ronald
Thanks for the good opening question (Ask what parents recall from algebra) for our parents presentation. I agree that what people remember is whether they liked a class.....I have my students interview their parents for a math memory project. It has always been enlightening.....many people have bad memories from math

> courses and yet as adults value mathematics especially for their children. Their memories seem to be strongly related to their feelings about the teacher, how they felt the teacher treated them, the things they did and then what they learned.

All of the stories are personal in nature. It is clear that they are presented to further the conversation, but they do not offer an opinion or judgement of any kind.

Quantitatively, it is clear that the reply was the most popular form of message. This could be because of the freedom in the types of replies that could be used, as evidenced by the number of types, and the feeling of not having to break new ground. Opinions were valued as acceptable replies, as were facts.

The most popular types of replies were answers and parables. This combines nicely with the information sought in the questions. Teachers are interested in facts and in what others do. It is clear that the opinions of others are highly valued. I found the large number of reply support messages surprising. In other, unrelated, electronic groups I have perused, I have not found that messages of this type as common. This could be attributed to the newness of on-line communication to this group, or it could be an indication that teachers interact by being encouraging.

I am confident that the categories of statement, question, and reply are justified by the data. In addition, each type I have identified appears to be different from other types. The use of the ideas of the center and border resources (Brown and Duguid, 1994) helped to make the distinctions more clear. I expect that these categories and types will be useful when looking at other sets of messages written by teachers. It is not clear that they are as applicable to sets of messages written by non-teachers.

Next Steps

I think that the next step should be to use these categories and types to classify another set of messages from MATHLINE. If they are useful for that, then another set from a different source

should be classified. Once there is some confidence that the categories and types are complete, they can be compared to the systems suggested by Gal and DiMauro (1994), West et al. (1989) and any others in the literature base and eventually be used for other types of studies.

A set of data could be categorized and then examined in terms of the participants. It is possible that the members of the group fill different roles by posting different types of messages. The proportions of different types of messages could also be examined. It would be informative to see if the proportions of different types of messages varied in different groups and if these differences affected the success of the groups. Groups of messages that participants found useful could be categorized to see if there are any common characteristics. It would be particularly informative to see if the types of messages an individual writes change as that person's teaching practices change.

If a framework such as the one developed in this paper is useful for the individual messages, a similar one may be able to be developed for conversations. In a quick overview of the data I used, it appeared that there were a number of different types of conversations. Some began with a single message with many messages radiating from the single message. In other conversations, the progression was much more linear, with one message building upon the previous one. Further investigation of this could be useful. It is possible that a framework of conversations could be combined with the message framework proposed here to provide a more complete picture of on-line communication.

At the beginning of this paper I proposed a larger project to look at three interrelated components of teacher-to-teacher on-line communication. I think that this framework, if validated using other data, would be useful in the larger study. I could use the framework to characterize the messages of individual participants and look for trends in participation. It seems possible that people who join for different reasons will participate in different ways and that those who participate differently will perceive different benefits. I hope to explore these possibilities.

I found the process of identifying the categories and types interesting, and I hope they are

useful for future work. I think that this type of careful description will be necessary as researchers investigate on-line communication to help mathematics teachers in the reform process.

References

Brown, J. S. & Duguid, P. (1994). Borderline issues: Social and material aspects of design. Human Computer Interaction, 9 (1), 3-36.

DiMauro, V. & Jacobs, G. (1995) Collaborative Electronic Network Building. Forthcoming in *The Journal of Computers in Math and Science Teaching*, February.

Gal, S. & DiMauro, V. (1994) Inquiry into Science Teaching by a Network-Mediated Science Teachers Community. *Telecommunications in Education News*, 5(2).

Huberman, M. (1993). The model of the independent artisan in teachers' professional relations. In J. W. Little & M. W. McLaughlin (Eds.), Teacher's work (pp. 79 - 103). New York: Teachers College Press.

Jacobs, G. & DiMauro, V. (1995) *Active Readers -- What Benefits do they Gain form an Educational Telecommunications Network* Paper presented at the International Conference on Technology Education, Orlando, FL.

McLaughlin, M. W. (1993). What matters most in Teachers' workplace context? In J. W. Little & M. W. McLaughlin (Eds.), Teacher's work (pp. 79 - 103). New York: Teachers College Press.

National Center for Research in Mathematical Sciences Education & Freudenthal Institute. (Eds.). (In press). Mathematics in context: A connected curriculum for grades 5-8. Chicago: Encyclopaedia Britannica Educational Corporation.

National Council of Teacher of Mathematics. (1991). Professional standards for the teaching of mathematics. Reston, VA: Author.

National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: Author.

Paget, K. F., Ishihara, N. G. & Roberts, E. (1995). *Who Talks to Whom and Who Knows What: The NGS KidsNetwork Middle Grades Teacher Forum* Paper presented at American Educational Research Association Annual Meeting, San Francisco, CA.

Public Broadcasting Service. (1995). Frequently asked questions about MATHLINE [On-line]. Available: http://www.pbs.org/learning/mathline/mlfaq.html

Weir, S. (1992) Electronic Communities of Learners: Fact of Fiction. (ERIC Document Reproduction Service No. ED 348 990).

West, M. M. K, Inghilleri, M., McSwiney, E., Sayers, D., & Stroud, K. (1989) Talking about Teaching, by Writing: The use of Computer-Based Conferencing for Collegial Exchange among Teachers. (ERIC Document Reproduction Service No. ED 303 363).